LABOR SAVING ON DAIRY FARMS

by

BENEDICT H.Y. KU

B. S., School of Agriculture, St. John's University, Shanghai, 1948

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INTRODUCTION

Men build businesses. In other words, every business needs manpower, some more and some less. Agricultural industries have a high labor requirement. Among farming businesses, fruit, date, celery and dairying require a large amount of labor while sheep production and wheat farming are recognized as less labor dependent industries. The fact that dairy farms have a higher labor requirement than all other types of farming except truck gardening is well recognized. Because of this, labor is a limiting factor in dairy farming (1, 17).

Labor represents the second largest cost item, being exceeded only by feed (5, 6). Engene (4) stated that the labor cost represents more than 30 percent of the total cost. Labor saving on dairy farms has been a problem which has received a great deal of attention in recent years. High labor efficiency reduces cost, and labor cost can be reduced as much as 65 percent and returns can be increased by as much as fifty cents per hour (3). Much interest has been developed in effective means of saving labor. There is no one most efficient way, but only to eliminate all unnecessary tasks (5). Engene (4) stated that by watching all the details is the most efficient way. He further stated that the best method of technique should be used and mechanized methods used when feasible. Two or more jobs may be combined. Labor saving makes a great difference in costs and returns. In general the saving of labor is carried out under the following items:

1. The use of labor-saving equipment

2. The arrangement of the dairy stable
3. The simplification of dairy barn chores (7)

THE USE OF LABOR-SAVING EQUIPMENT

Use of equipment and machines are simple ways to reduce chore time (15). Atkeson (1) stated that the type of equipment will affect the labor needs. Carter of Michigan (3) said that the use of labor-saving equipment was a factor associated with low requirement. Milking machines were first considered as the greatest single piece of labor-saving equipment. The use of grain and ensilage carts can save steps and reduce the length of time spent in barn work (7). The size of feed carrier can save time (18). Fig. 1 shows the most and the least efficient farmers in doing chore work. O'Brien (10) reported that one farmer built new cribs and granaries equipped with elevators, feed grinder and mixers with power to save hand labor. He also reported that on the same farm, pit-milking set-ups, power gutter cleaners and electric water heaters were used to save time and also cost.

Rapid Milking. The practice of labor saving with milking machines is simple with the introduction of rapid milking. Hoff (7), Woodworth, Morrow and Holmes (11) and Woodworth and Morrow (12) said that 3.5 minutes of milking per cow was a practical goal. By use of the rapid milking method, the length of time necessary to milk a cow has been reduced from ten minutes to four minutes (11). Quick milking and quick stripping are corner-stones of good milking procedure and essential parts of any program which seeks to economize on labor in doing barn chores. By checking the time with machine on each cow and the time it

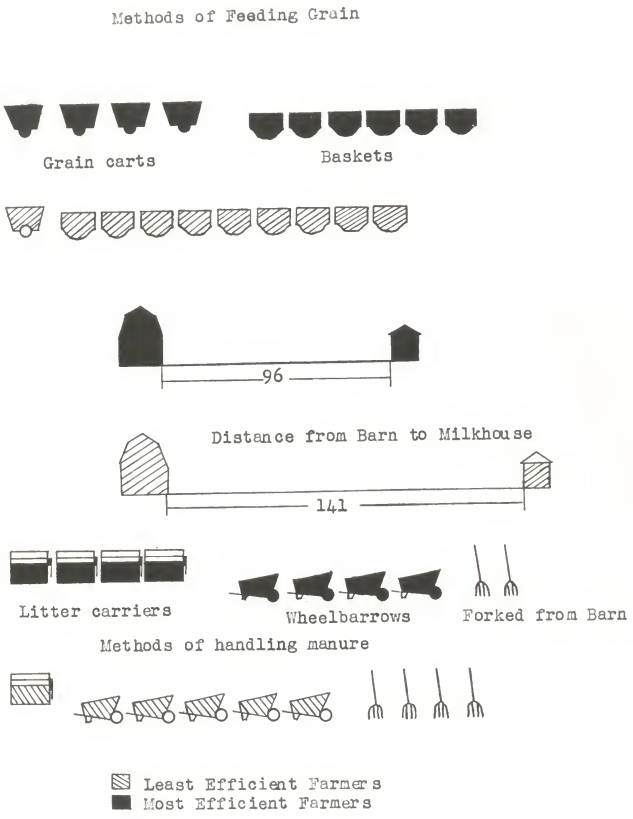


Fig. 1 Comparison of the most and the least efficient farmers in doing chore work (3)

takes to strip each cow is a good practice. Carter of Vermont (2) stated that most cows can be trained to milk out in 3 to 5 minutes. On most farms the time of milking for each cow is controlled by the watch. Carter (2) stated that this is not the only way of doing a good job of milking, but is a sound method, simple, effective and much better than those now commonly used to indicate when the machine should come off. Time of stripping is also a problem involved. Carter (2) reported that the time needed to strip varies widely from cow to cow and may differ from time to time with the same cow.

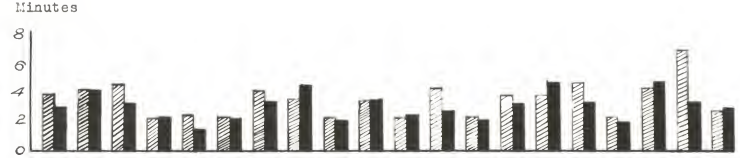
In the rapid milking practice one should consider the rate of milk let-down. The rate of milk let-down between individuals and between herds was even more important than work simplification (11). Woodworth, Morrow and Holmes (11) stated that the speeding up of milk flow requires some adjustment in all the practices and occassionally new or additional equipment is required. The adjustment is shown as follows:

1. Milking is a special task.
2. Cull out all hard milkers and cows with abnormal or diseased udders.
3. Conveniently arrange the barn and milk house.
4. Provide strainer with adequate volume extra milk pail.
5. Hot massaging of the udder and fore milking.
6. Three minutes milking transfers milker from one cow to another.
7. Milk cow in three and half minutes.
8. Machine stripped half minute.
9. A trip made to each two cows, one minute is assumed.

They (11) again stated that the division of labor would be more equal if one man operated the machines and the other prepared the cows and carried the milk. If an operator is over-pressed, he does not take advantage of rapid milking. Rapid milking has brought a revolution to the dairy industry. Williams of Vermont (16) stated that among the herds he visited, the machine time averaged 6.5 minutes per cow; the stripping time 1.6 minutes and the weight of strippings 1.2 pounds. The length of time the machines were left on apparently did not affect the duration of stripping or the weight of the strippings. Furthermore, neither the make or the age of the machine nor the average milk production per cow was appreciably related to either the speed or the completeness of the machine milking. Among 14 herds milked by machine, total milking time ranged from 3.0 to 8.1 minutes, and walking distance from 78 to 209 feet per cow. These differences in labor requirements seem due in the main to differences in the practices which individuals regard as necessary parts of their milking procedure, in building arrangement, in equipment and in the care with which the work is planned. On the basis of experience on one Vermont farm, where changes in method, barn arrangement and equipment were made an effect on time and travel observed, it appears that proper attention to these points makes possible important saving of labor. Besides the saving of labor on milking machines the advantage of consistency is also apparent. Woodworth, Morrow and Holmes (11) stated that in the fast-milking herd, there was a considerable uniformity in the time required to milk individual cows and the milking time for each cow morning and night was consistent. On the other hand, in the slow-milking herd

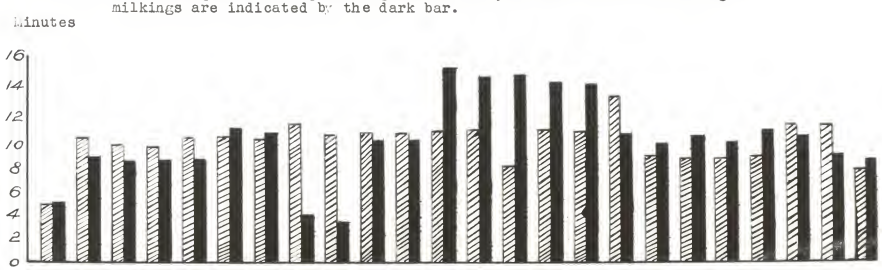
the machines were left on most cows more than 8 minutes and in several instances more than 14 minutes. There was little consistency between morning and night records. The phenomenon will be shown in Fig. 2. Woodworth, Morrow and Tarbell (13) stated that the average time the machines were on the cows was reduced from 6.6 minutes to 4.2 minutes. They (13) found that there was a slight reduction of milk the second day under the new procedure, but on the third day, production was back to normal. They (13) again stated that additional milker pails are required to take full advantage of the milking procedure. Certain operators have learned to shift the milker head from a full to an empty pail very quickly and the machine is in operation on another cow within a short period. With extra pails at hand, the milking machine unit is in operation while one of the men carries the full pails to the milk house. The data indicated that the combination of two single units and two men does not make the most effective use of man-labor. Three single units and two men make a good combination. In large dairy, four single units were too much for two men when using the rapid milking procedure. Davis (4) explained that one farmer using a single unit machine requires about 1 to 1½ hours to milk 18 to 20 cows.

In rapid milking it is essential that the machines are in good mechanical order. Carter (2) stated that a careful survey of its conduct to make sure that the pulsation rate and the vacuum, at the teat cups as well as at the stanchion line, are in accordance with the manufacturer's recommendations. See that the inflations are in good condition free from checks and pinholes, and that they fit smoothly into the shells.



20 Individual Cows

The average machine time in the fastest milking herd was 3.5 minutes The morning and evening milkings were fairly consistent. The evening milkings are indicated by the dark bar.



23 Individual Cows

The average machine time in the slowest milking herd was 9.6 minutes. Machines were left on cows over 14 minutes in some instances. There was little consistency between morning and evening milkings.

Fig. 2 (11) Comparison of night and morning milkings in slow and fast milking herds.

There have been recent modifications of the rapid milking method. Those practices are the elimination of the labor of carrying milk to the milk house. Some barns have a glass container fixed above the cow. The milk in the container is drawn to the storage tank. Some farms have a pipe system by which the milk can be pumped directly to the milk house. Gordon (6) explained that the Excelsior Dairy at Santa Ana, California, uses a new method in milking in which milk is extracted by machine directly into the pipeline, then to a cooling tank. In this method there are no buckets used. Fifty six cows are milked in an hour. The pipeline is flushed after each shift of three hours. It was found that the bacteria count of milk produced by this method was also very low. The pipeline is sterilized after nine hours of operation.

The disadvantages of rapid milking are the negligence of individual cows and also the resulting incomplete milking (6). Rapid milking practices have been developed extensively in dairy farms and also modifications are being suggested from time to time. However, this is considered as one of the chief methods of labor saving practices.

THE ARRANGEMENT OF THE DAIRY STABLE

The convenient location of the milk house and suitable barn arrangement were factors associated with low-labor equipment (3, 5, 11, 15, 18). Carter (2) reported an analysis through a single farm to show the importance of barn arrangement with regard to labor saving. He reported that he improved the barn arrangement as to place the cows in two nearly equal rows instead of in a

long and short row; opening a cross alley at the north end of the stanchion line, so that it was possible to pass completely around the cows in the performance of a given chore job; cutting a new door in the east wall of the barn; moving the horses from the west side of the barn to the northeast corner, near the new exit door; removing the partition from around the saw dust bin and silage chute. The original layout and the revised layout are shown in Figs. 3 and 4. This rearrangement saved 2 hours and 5 minutes time, and 2 miles of travel daily. These savings represent 36 and 62 percents respectively, of the original time and travel. Figs. 5, 6, 7, 8 and 9 will give us an idea of saving travel distance under various arrangements of milk house and silo, either located at the end of barn or at the side middle of the barn (8). The following data taken from Holmes' (8) report show the difference in travel between good and poor arrangements for a 40-cow barn, as in Table 1.

Table 1. Minimum chore travel

	Times daily	Cows face out		Cows face in	
		Location	Travel ft.	Location	Travel ft.
Milkhouse (1 trip 2 cows)	2	end	3680	end	4840
Silo	2	end side end side middle	450	end	324
Grain Room	2	end side end side middle	450	end	324
Super-phosphate Storage	1	end side end side middle	225	end	162
Bedding Storage	2	end side end side middle	450	end	324
Manure Disposal	1	side end	624	side end	624
			5879		6598

Original Layout

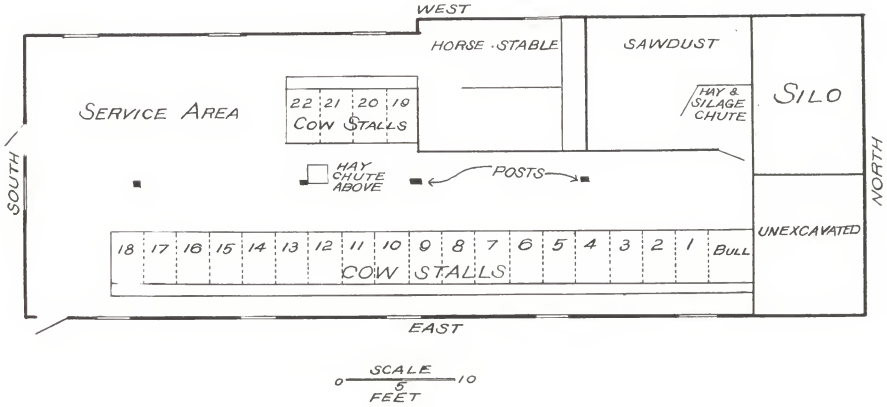


Fig. 3 Floor plan of stable (2)

Revised Layout

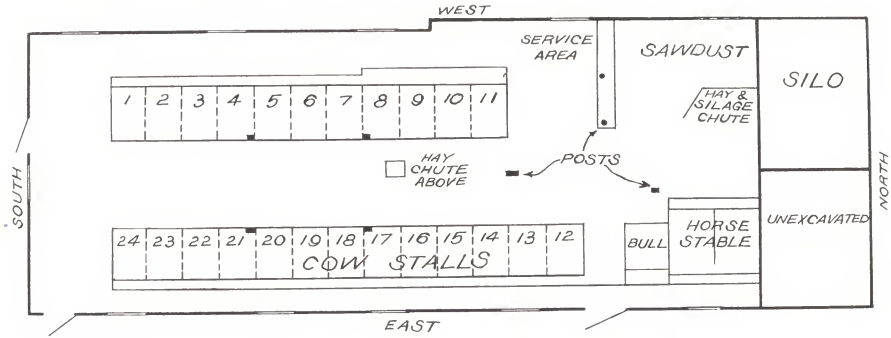
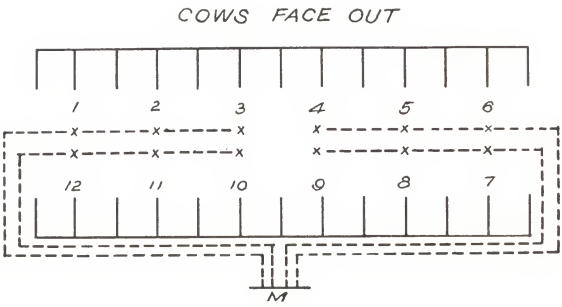
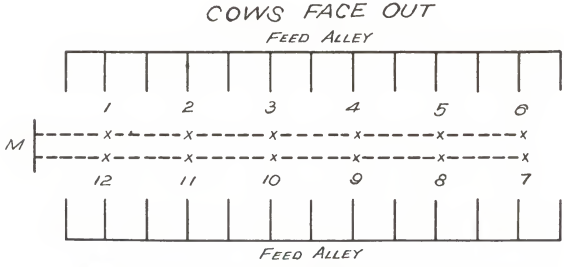


Fig. 4. Floor plan of stable (2)

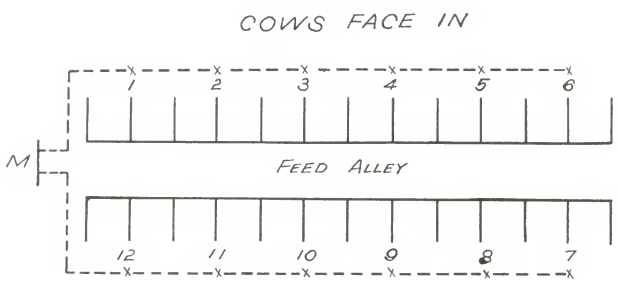
Milk house travel in a 24-cow barn, facing out, and milk house at the side middle. Assuming one trip for each two cows the total travel would be 1368 feet in this case.



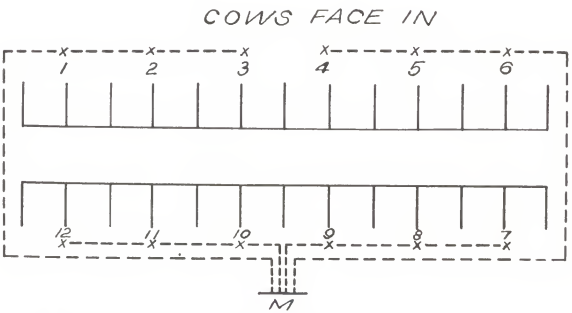


Milk house travel in a 24-cow barn, cows facing out, and milk house located at the end. Assuming one trip for each two cows the total travel would be 768 feet in this case.

Fig. 5 (8)



Milkhouse travel in a 24-cow barn, cows facing in, and milkhouse located at the end. Assuming one trip for each two cows the total travel would be twice the sum of distance from M to 1 plus M to 2 etc. up to M to 12. This would be 1116 feet in this case.



Milkhouse travel in a 24-cow barn, cows facing in, and milkhouse on the side middle. Assuming one trip for each two cows the total travel would be 1116 feet in this case.

Fig. 6 (8)

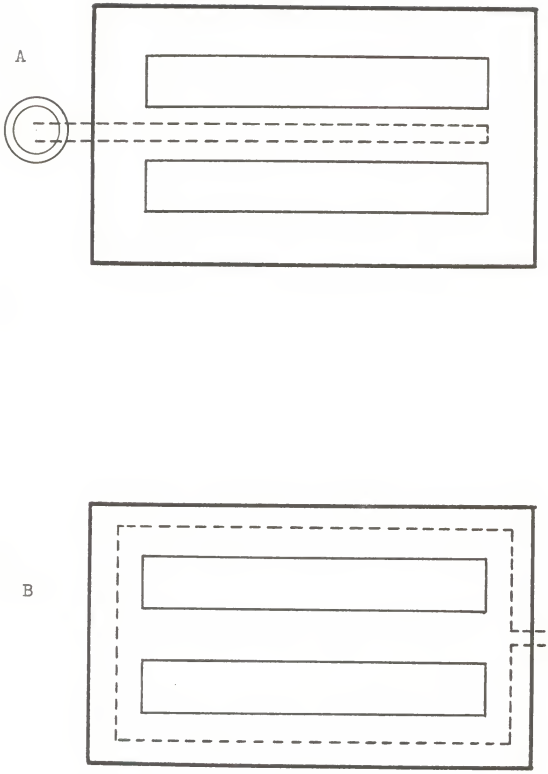
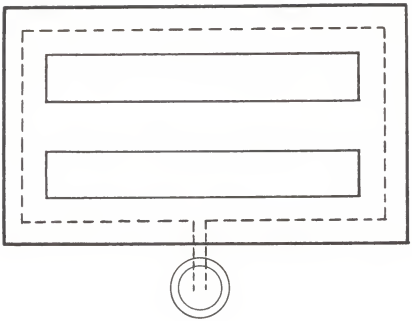


Fig. 7. Travel in feeding silage with one trip when silo is located at the end of barn. Figure A shows travel when cows face in and Figure B when cows facing out. Forty cows would require 162 feet travel per feeding in Figure A and 225 feet in Figure B.

A



B

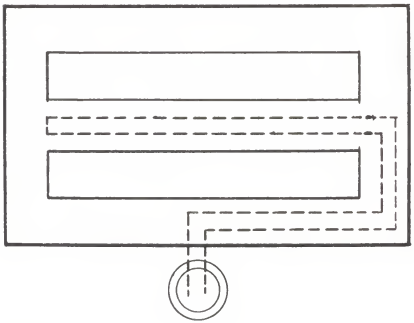
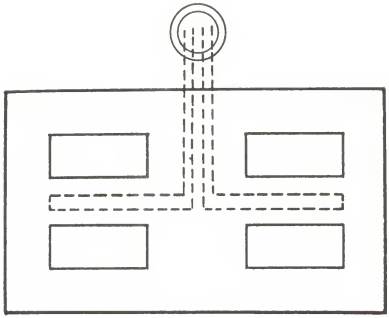
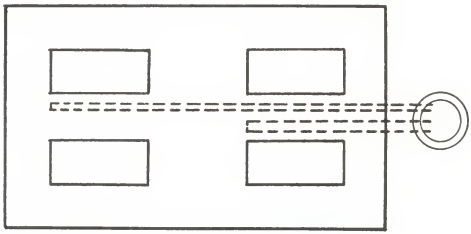


Fig. 8, Travel in feeding silage with one trip when silo is located at the side middle. Figure A shows travel when cows face out and Figure B when cows face in. Forty cows would require 225 feet travel per feeding in Figure A and 266 feet in Figure B.



Travel in feeding silage under the following assumptions: cows face in, center cross alley, silo located at the side middle and two trips required. Sixty cows would require 312 feet travel each feeding.



Travel in feeding silage under the following assumptions: cows face in, center cross alley, silo located at the end of barn, and two trips required. The diagram shows one round trip to feed cows left of center on both sides of the barn. The travel in this case would be less than when each trip service cows on one side of the barn. Sixty cows would require 369 feet travel each feeding.

Fig. 9 (8)

Holmes (8) stated that the distance travelled is an important factor in chore efficiency. He explained that the milk house travel in any type of barn could be approximated by the use of a mathmetical formula as shown in the following formula:

$$7/8\ N^2+25\tfrac{1}{2}\ N = \text{Total travel feet}$$

N equals the number of cows

This formula is applicable whether the milk house is located at the end, side end or side middle if the cows face in. If the cows face out and the milk house is located at the middle of one side the formula is as follows:

$$21/16\ N^2+25\tfrac{1}{2}\ N = \text{Total travel feet}$$

If the cows face out and the milk house is located at the end (no center alley)

$$7/8\ N^2+11\ N = \text{Total travel feet}$$

It can be seen that minimum travel results from an end location of the milk house with the cows facing out.

The next lowest travel is required with a side end location with the cows facing out or any of the three locations with the cows facing in. The maximum travel is required with a side middle location with cows facing out. Minimum travel results from an end silo location and cows facing in. Maximum travel is necessitated with a side middle location and cows face in.

Travel to and from the milk house represents a large part of the total, and depends on the number of cows taken per trip. It has also been shown that both milk house travel and manure disposal travel increase more or less in proportion to the square of the number of cows (8).

Holmes (8) calculated the general formulae for milkhouse travel, if no center alley exits.

Location of Milkhouse		Cows facing:
End	$F = 2n(\frac{1}{2}SN + e + P)$	Out
	$F = 2n(\frac{1}{2}SN + \frac{W-b}{2} + e + P)$	In
Side end	$F = 2n(\frac{1}{2}SN + \frac{W+e}{2} + P)$	Out
	$F = 2n(\frac{1}{2}SN + \frac{W+e}{2} + P)$	In
Side middle	$F = 2n(3/8SN + \frac{W+e}{2} + P)$	Out
	$F = 2n(\frac{1}{2}SN + \frac{W+e}{2} + P)$	In
	With center alley	
End	$F = 2n(\frac{1}{2}SN + e + P + \frac{1}{2}a)$	Out
	$F = 2n(\frac{1}{2}SN + \frac{W+e-b}{2} + e + P)$	In
Side end	$F = 2n(\frac{1}{2}SN + \frac{W+e+e}{2} + P)$	Out
	$F = 2n(\frac{1}{2}SN + \frac{W+e+e}{2} + P)$	In
Side middle	$F = 2n(1/8SN + \frac{W+e}{2} + P)$	Out
	$F = 2n(1/8SN + \frac{W+e}{2} + P)$	In

F = Round trip travel in feet
N = Number of cows
n = Number of trips
W = Width of barn
S = Width of cow stall
e = Width of end alley
b = Width of litter alley
a = Width of center alley
P = Distance outside barn to milk containers (one day)

Note:
If cows are taken three at a time n equals N/3

Holmes (8) also stated that similar formulae have been worked out for silo travel and for manure disposal travel. He (8) reported that as the size of the herd increases, the difference in travel for the combined chores will become more marked.

Carter (2) suggested that the following score card should be at hand on every dairy farm to check the layout of the barn in order to save labor.

Dairy Barn Layout Score

Condition	Points Maximum allowed
Related to reduction of distance travelled:	
Circular travel possible around all stanchion lines	10
All milking cows in one barn	7
Milk house close to cows	8
Convenient hay chutes and entrance to hay loft directly from stable	6
Silo located conveniently to feed alley	5
Convenient storage of bedding	4
Good relation to entrances and exits to other buildings and yards on farmstead	3
Related to reduction of time involved:	
Proper width for alleys and walks	7
Satisfactory provision for unloading and storage of grain	5
No calves tied in passages	4
Wide exit door for cows	3

Feed mangers smooth and easy to sweep 2

Silo door and chute permit loading of cart directly from silo 2

Barn width not too great for satisfactory natural lighting 1

Related to reduction of fatigue:

Open layout-no necessary partitions 4

Level floor throughout 5

Easy method of disposing of manure 5

No steps upward or sills at exit doors 4

Adequate natural and artificial lighting 4

Adequate service area for cart storage, etc. 2

No necessity for carrying feed through litter alleys 3

Manure ramp, if present, rigid, wide and not too steep

carrier, if used, rigidity suspended and level .. 2

Horses, when housed in stable, close to exit door . 2

Minimum stable height of 6 feet 6 inches 1

Gates, bars and cross chains as needed 1

Total Score 100

Barn on farm of ..... at .....

Date .....

SIMPLIFICATION OF CHORES

The combination of two jobs at one time is a simplification of chores (7,5,12,4). As an example the cows can be fed while milking. In this respect it is necessary to have a work routine developed to simplify chores. Carter (3) stated that the degree of chore planning also was a contributing factor to lower labor

requirement.

There are several other practices proved to save time and labor, such as the arrangement of tools and the position in which the worker stands. Murphy (9) stated that proper arrangement of work behind the cows may save 60 percent of time and 45 percent of distance travelled.

There are correlations among the three above mentioned items. Chore simplification can be accomplished by proper arrangement of barn or by using of labor saving equipment. However, the limitation of adopting labor saving equipment is due to its high initial cost. The expenses of purchasing labor saving equipments and the rearrangement of barn are usually high and it is impossible for some farmers to pay much at one time in order to save labor cost in the future.

LOOSE HOUSING SYSTEM

In recent years much interest has developed in the loose housing or loafing shed system of housing dairy cattle. In many ways the loafing system is better than the conventional type. Witzel and Wilkins (15, 18) stated that a well planned loose housing system can reduce and simplify dairy chores. They (15) also explained that loose housing for dairy cattle has been practised. The loose housing system and the milking parlor provide a new development in dairy cattle housing.

Advantages of Loose Housing

There are several advantages of loose housing, such as:

1. It fits itself into existing buildings quite readily.

Space can be provided by buildings of the simplest type, lowest cost construction, which offers a practical low cost method of sheltering the dairy herd.

2. The loose housing system is flexible as to size and use. One cow will be as comfortable as sixty. It is open and this affords the greatest possible fire safety for the herd when operated with outside doors open at all times.

3. For new construction, one story buildings will prove least expensive and most economical. One story buildings are less likely to be damaged by windstorm.

4. Manure storage and preservation in the loose housing system can be managed so as to practically eliminate losses of fertility.

5. The loose housing system has less dampness and odors than the warm barn even though well ventilated. Witzel and Wilkins (15) stated that Holstein cows can be expected to do at least equally well in the loose housing system as in the warm stanchion barn.

Disadvantages of Loose Housing System

In contrast to advantages, there are also disadvantages:

1. Its use is limited in rather dry regions.

2. Horns on cattle seem to invite trouble in the loose housing system and they should be removed.

3. The loose housing system seems to rob the veterinarian of a suitable place to work on the cattle.

4. A pen along the corner of cow lot should be provided for new animals brought into herd.

Planning the System

The first step in planning is to think of the loose housing system as being made up of from separate units (15); the feeding area, the bedded area, the improved barn lot and the milking parlor. Witzel and Wilkins (15) again stated that for greatest success in planning and operation, an entirely new approach is required. The thinking, the buildings and equipment and the management are different with that of the convention type. Therefore many people have proved that it is easy to get into trouble with loose housing and have given up in disgust. The future of loose housing will rest in the hands of those dairymen who see in it the advantages that will make it the best kind of housing for them (15).

Comparisons of several features of a stanchion barn with a loose-run barn were shown in the following data from the report by Witzel and Wilkins (15).

Comparative Results of the Stanchion Barn and Uninsulated, Open, Loose-run Barn at the University of Wisconsin for the Past Three Years

	Stanchion barn	Loose run barn
	percent	percent
1. Temperature (29.04 F. outside)	53.52 F.	37.13 F.
2. Humidity (72.95% outside)	82.02	78.04
3. Manure pack temperature - ave. 3" from surface		84.33 F.
4. Stall barn floor temperature Average	57.7 F.	
5. Labor comparisons		
A. Actual summary of original time studies	100	82.0

B. Actual time for cleaning loose-run barn loafing area, mechanically	100	83.7
C. Actual time for cleaning loose-run barn loafing area by hand	100	91.9
6. Feed consumed (cow-day basis)		
A. Silage	100	104.18
B. Hay	100	103.65
C. Concentrates	100	100.75
D. Total digestible nutrients	100	102.83
7. Bacterial Counts		
A. Arithmetic average on pooled raw milk	5,724	8,364
B. Arithmetic average - counts on pasteurized samples of pooled milk	177	135
8. Bedding (cow-day basis)	100	102.83
9. Milk production (4% fat basis)		
A. On a total cow basis		
Pounds per day	29.42	31.32
Per cent fat	3.55	3.66
Per cent of stanchion barn record	100	106.46
B. On a milking cow basis		
Pounds per day	34.6	35.74
Per cent of stanchion barn record	100	103.29
C. Pounds nutrients per pound milk (4% produced)	100	96.6
D. Cost per pound milk (4%) produced with conc. @ $60; hay @ $20; Silage @ 1/3 hay cost	100	96.11
10. Cow weights ave. gain per cow per tested Period	6 Lbs.	34 Lbs.

11. Calves

A. Gain per calf per day	100	88.14
B. Lbs. nutrients consumed per Lb. gain	100	85.71
C. Lbs. bedding per calf per day	100	73.39

A review of the literature relative to labor saving on dairy farms suggests the following comments:

1. The most important requirement is a real desire to save time and to find easier ways of doing the work.

2. Accept any outsider who has good judgment and suggestions. An outsider will often see things which escape the attention of one who sees them every day.

3. Draw a plan of the barn to scale and mark on it the location of tools and supplies. Small changes that will save steps may show up more clearly on a diagram than they do on the ground. Especially if some major rearrangement is being considered, study the possibilities carefully on paper before coming to a decision.

4. Every minor saving must be carefully taken care of though it may seem unimportant. Small amounts apt to be neglected unconciously but they may influence the whole sum.

5. Go over each job in detail, one at a time and see if there are any frills that could be left off without loss.

6. Give thought also to the order of work, to the manner in which jobs fit together. The main outlines of the work plan are largely fixed by the needs of the stock, but some slight change may save a trip as to the length of the barn, or shorten some operation by a few seconds. Change proposed in one job may

affect others as well, and routines should be planned in the interest of the greatest total saving.

7. Careful thought should be given to any rearrangement before it is undertaken since work routines can not be studied apart from their settings. This leads back again to a consideration of barn arrangement.

8. When a change is made the effect on the time taken to do the job may not appear at once. The worker has to become accustomed to the new method or the new arrangement before any saving becomes manifest.

9. Note the time that it takes to do the different jobs so that you can judge of the progress made.

To draw a conclusion, anyone who wishes to do a wise job on labor saving must keep their eyes open for ways to make the work easier. Be receptive to ideas, but also be critical of them.

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